



Exercise set (1.2)

SECTION 1.2 Exercises

In Exercises 1–8, determine the size of the matrix.

1.
$$\begin{bmatrix} 1 & 2 & -4 \\ 3 & -4 & 6 \\ 0 & 1 & 2 \end{bmatrix}$$

3x3

3.
$$\begin{bmatrix} 2 & -1 & -1 & 1 \\ -6 & 2 & 0 & 1 \end{bmatrix}$$

2x4

5. $[1 \quad 2 \quad 3 \quad 4 \quad -10]$

1x5

7.
$$\begin{bmatrix} 8 & 6 & 4 & 1 & 3 \\ 2 & 1 & -7 & 4 & 1 \\ 1 & 1 & -1 & 2 & 1 \\ 1 & -1 & 2 & 0 & 0 \end{bmatrix}$$

4x5

8.
$$\begin{bmatrix} 1 \\ 2 \\ -1 \\ -2 \end{bmatrix}$$

4x1

In Exercises 9–14, determine whether the matrix is in row-echelon form. If it is, determine whether it is also in reduced row-echelon form.

9.
$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

matrix in reduced row echelon form

10.
$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 2 & 1 \end{bmatrix}$$

not row echelon form

In Exercises 9–14, determine whether the matrix is in row-echelon form. If it is, determine whether it is also in reduced row-echelon form.

11.
$$\begin{bmatrix} 2 & 0 & 1 & 3 \\ 0 & -1 & 1 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

row echelon form

not reduced row echelon form

13.
$$\begin{bmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 2 & 0 \end{bmatrix}$$

not row echelon form

14.
$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

row echelon form

reduced row echelon form

In Exercises 15–22, find the solution set of the system of linear equations represented by the augmented matrix.

$$17. \begin{bmatrix} 1 & -1 & 0 & 3 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & 1 & -1 \end{bmatrix}$$

$$x - y = 3$$

$$y - 2z = 1$$

$$z = -1$$

$$z = -1$$

$$y - 2z = 1$$

$$y - 2(-1) = 1 \Rightarrow y + 2 = 1$$

$$y = 1 - 2 \Rightarrow y = -1$$

$$x - y = 3$$

$$x - (-1) = 3$$

$$x = 3 - 1$$

$$x = 2$$

Solution set $x = 2, y = -1, z = -1$

In Exercises 23–36, solve the system using either Gaussian elimination with back-substitution or Gauss-Jordan elimination.

$$23. \quad x + 2y = 7$$

$$2x + y = 8$$

$$\begin{bmatrix} 1 & 2 & 7 \\ 2 & 1 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 7 \\ 0 & -3 & -6 \end{bmatrix} \quad -2R_1 + R_2 \rightarrow R_2$$

$$\begin{bmatrix} 1 & 2 & 7 \\ 0 & 1 & 2 \end{bmatrix} \quad -\frac{1}{3}R_2 \rightarrow R_2$$

$$x + 2y = 7$$

$$y = 2$$

$$y = 2$$

$$x + 2y = 7$$

$$x + 2(2) = 7$$

$$x + 4 = 7$$

$$x = 7 - 4 = 3$$

$$x = 3$$

$$29. \quad x_1 - 3x_3 = -2$$

$$3x_1 + x_2 - 2x_3 = 5$$

$$2x_1 + 2x_2 + x_3 = 4$$

$$\begin{bmatrix} 1 & 0 & -3 & -2 \\ 3 & 1 & -2 & 5 \\ 2 & 2 & 1 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & -3 & -2 \\ 0 & 1 & 7 & 11 \\ 2 & 2 & 1 & 4 \end{bmatrix} \quad -3R_1 + R_2 \rightarrow R_2$$

$$\begin{bmatrix} 1 & 0 & -3 & -2 \\ 0 & 1 & 7 & 11 \\ 0 & 2 & 7 & 8 \end{bmatrix} \quad -2R_1 + R_3 \rightarrow R_3$$

$$\begin{bmatrix} 1 & 0 & -3 & -2 \\ 0 & 1 & 7 & 11 \\ 0 & 0 & 7 & -14 \end{bmatrix} \quad -2R_2 + R_3 \rightarrow R_3$$

$$\begin{bmatrix} 1 & 0 & -3 & -2 \\ 0 & 1 & 7 & 11 \\ 0 & 0 & 1 & 2 \end{bmatrix} \quad -\frac{1}{7}R_3 \rightarrow R_3$$

$$x_1 - 3x_3 = -2$$

$$x_2 + 7x_3 = 11$$

$$x_3 = 2$$

$$x_3 = 2$$

$$x_2 + 7x_3 = 11$$

$$x_2 + 7(2) = 11$$

$$x_2 + 14 = 11$$

$$x_2 = -3$$

$$x_1 - 3x_3 = -2$$

$$x_1 - 3(2) = -2$$

$$x_1 - 6 = -2$$

$$x_1 = -2 + 6$$

$$x_1 = 4$$

$$34. \quad x + 2y + z = 8$$

$$-3x - 6y - 3z = -21$$

$$\begin{bmatrix} 1 & 2 & 1 & 8 \\ -3 & -6 & -3 & -21 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 8 \\ 0 & 0 & 0 & 3 \end{bmatrix} R_2 + 3R_1 \rightarrow R_2$$

$$0x + 0y + 0z = 3$$

The system is inconsistent